and the northeastward movement continued throughout the day.

On 1 and 2 April my observations were on the coast, mainly around Pangani, south of Tanga. The rain had stopped and these days were predominantly sunny with light southeast winds. A continuous stream of European Rollers migrated up the coast on both days, accompanied by European Swallows and small parties of unidentified falcons. Although the northeastward movement of rollers was seen inland, there was obviously a concentration of birds migrating up the coast. I did not attempt to estimate numbers, but on 1 and 2 April certainly tens of thousands coasted past and the numbers may have reached 6 figures.

On 3 April European Rollers were comparatively scarce on the journey from Pangani to Korogwe with *C. garrulus* and *C. caudata* in about equal numbers. In the Korogwe area, about 100 km inland, migration of European Rollers was still observed on 3 and 4 April, but their numbers and concentration were much lower than on the coast. Furthermore, the direction of migration at Korogwe was east of northeastward, suggesting that the birds were heading for the coast, possibly to avoid flying over the Usambara mountains. On subsequent journeys in the Arusha, Dodoma and Manyoni areas very few European Rollers were seen.

These observations suggest that the mass-migration reported by Ash & Miskell (1980) may be regular. In addition, it appears that the evacuation of the wintering area by European Rollers occurs over a relatively short period, possibly a fortnight or less.

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References:

Ash, J. S. & Miskell, J. E. 1980. A mass-migration of Rollers *Coracias garrulus* in Somalia. *Bull.Brit.Orn.Cl.* 100: 216–218.

Moreau, R. E. 1972. *The Palaearctic-African Bird Migration Systems*. London: Academic Press.

Address: Dr. C. J. Feare, MAFF Worplesdon Laboratory, Tangley Place, Worplesdon, Guildford, Surrey GU3 3LQ, UK.

Description of the downy young of Lichtenstein's Sandgrouse *Pterocles lichtensteini* and the significance of "unpatterned" downy young in the Pteroclididae

by David H. Thomas and A. Paul Robin

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There does not appear to be any published description of the downy young of Lichtenstein's Sandgrouse *Pterocles lichtensteini* (Harrison 1975), although it is hard to believe that such young have not been seen before by ornithologists. The following description is offered despite being based on a single individual and because the downy young's appearance in this and some other sandgrouse species is unusual in the Pteroclididae. The possible significance of this will be discussed.

Observations were made in the Moroccan Sahara (where Lichtenstein's

Sandgrouse is at the northwestern limit of its range) during the course of a study of the sandgrouse there (for a full description of the location and general ecological conditions there see Thomas & Robin 1977). At 08.20 on 28 May 1974, a pair of Lichtenstein's Sandgrouse with a single downy chick were found among boulders in stoney ground on the lower slopes of Jebel Bani (c. 30°N, 6°W), in the region of Foum Zguid. They were observed at 5–10 m range from a Landrover for about an hour, during which time the female and chick sheltered in the shade of a rock, while the male stood nearby, gular fluttering, in weak sunshine (air temperature 38°C and relative humidity 18% 1 m above the ground in the shade of the Landrover at 08.55). When later all 3 birds moved off unhurriedly, the chick walked almost under the female or very close to her shaded side, hiding immediately in the shadow of a rock when we followed. The chick was photographed at close range, the following description being made from 2 diapositives (projected) and also from notes made at the time. Colour codes are in Munsell notation (Munsell Color 1975), determined by comparison with the projected diapositive images, which may, of course, have shown some distortion from the true colour of the chick itself. Unfortunately no measurements were made, since we did not appreciate at the time that this plumage was undescribed.

Description of the downy young

Age. Unknown, but the plumage was entirely downy and showed no outward sign of any later feather development. Since it had already left the nest site, the chick was presumably at least one day old, and may have been 2–3 days old. Sandgrouse normally have clutches of 2–3 eggs, which may hatch at one day intervals, and chicks do not normally leave the nest until the last chick is hatched and dried (Maclean 1976).

Colouration. Crown and nape, throat, body, wings, thighs and the feathered anterior aspect of the tarsus all of a markedly uniform warm donkey brown, only slightly paler ventrally (7.5YR 6/4) than dorsally (7.5YR 5/4). Lores, supercilium, ear coverts and below the eye a somewhat darker brown (light chocolate: 7.5YR 3.5/4), demarcated below by a short pale moustachial-stripe and above by a long pale lateral-crown stripe running from the bill to the back of the head, the pale stripes irregular in width and alignment. A pale spot just below and behind the eye was the same creamy buff (7.5YR 8/4) as the other 2 pale strips (see Fig. 1). The texture of the down appeared very uniform, rather like dense velvet. The bare parts (bill, a narrow eye ring, toes and the posterior aspect of the tarsus) were light grey (5YR 6/1).

Discussion

The unusual feature of this downy plumage in comparison with that of many other sandgrouse species is the uniform colouration. Typically, downy young of sandgrouse are marked disruptively with mottled browns, buffs, black and white, more or less organised into symmetrically placed darker panels outlined and separated by paler lines, particularly on the head and dorsal aspect of the body. Specifically, this generalised description can be applied to the following species:

Syrrhaptes paradoxus, S. tibetanus (Fjeldsaa 1976, 1977); *Pterocles namaqua, P. alchata, P. quadricinctus* (Fjeldsaa 1976); *P. orientalis* (Fjeldsaa 1977); *P.*

Figure 1. View of the downy young of Lichtenstein's Sandgrouse *Pterocles lichtensteini*, showing the pattern of pale lateral-crown and moustachial stripes, the position of the pale spot below and behind the eye, the posterior margin of the darker facial colouring (dotted line between the pale stripes) and the otherwise unpatterned plumage. (Traced from a photograph; the bird was straddling a pebble, which obscured some plumage details.)

exustus (Aldrich 1943, Harrison 1975); *P. burchelli* (DHT's unpublished photographs of a chick collected by Mr. J. E. W. Dixon, Department of Zoology, University of Capetown, Rondebosch, S. Africa); *P. decoratus*, *P. gutturalis*, *P. bicinctus* (Mackworth-Praed & Grant 1952).

This list includes all members of the family (see Hüe & Etchécopar 1957) except the Madagascar Sandgrouse *P. personatus* (for whose downy young no description was found), Lichtenstein's Sandgrouse (in which the absence of patterning on the body has been noted already), and *P. coronatus*, *P. senegallus* and *P. indicus*, of which 3 species Fjeldsaa (1976: 213) comments that the downy young are "faintly marked . . . but the course of the light lines is nearly the same in all". Of these last 3 species, *P. indicus* is probably closely related to *P. lichtensteini* (and is possibly conspecific—Meinertzhagen 1954), and at least one description of the downy young of *P. indicus* (as "uniform earthy brown"—Ali & Ripley 1969:93) seems to conform to the present one of *P. lichtensteini*. Colour photographs of *P. coronatus* downy young (George 1978: plate 32) shows them to be not unlike *P. lichtensteini* chicks in the comparative uniformity of general colouration and with a darker facial patch, while *P. senegallus* is slightly more patterned than *coronatus* or *lichtensteini* (George 1978: plates 29–31, Mackworth-Praed & Grant 1952).

The slight or absent patterning in downy young of *Pterocles indicus, lichtensteini, coronatus* and *senegallus* may represent convergent adaptations to extreme desert conditions rather than any phyletically close relationship. There has not been a recent evaluation of relationships within the sandgrouse family, but Bowen (1927) showed the existence of 2 distinct species groups in *Pterocles* (based on plumage characteristics and drinking behaviour): on these criteria, *lichtensteini* seems close to *indicus, bicinctus* and *quadricinctus*, yet the latter 2 species have strongly patterned downy young. Similarly, *coronatus* and *senegallus* also seem otherwise phyletically close to species with more or less strongly patterned young (*P. alchata, orientalis, namaqua, exustus, gutturalis* and *burchelli*). Elsewhere we have shown that *P. lichtensteini, coronatus* and *senegallus* show marked adaptations for extreme desert conditions (Thomas

& Robin 1977), and *indicus* also is found in arid areas (Ali & Ripley 1969). Thus, it seems that the loss of the "typical" family patterning of downy young and adoption of more uniform colouration has evolved at least twice in sandgrouse, in association with existence in extreme deserts: once in the *P. lichtensteini/indicus* species group and again in the *P. coronatus/senegallus* group. Interestingly, *P. namaqua, bicinctus* and *burchelli* have "typically" patterned downy young, yet survive well in the Namib and/or Kalahari deserts (Maclean 1968, Thomas & Maclean 1981). However, these 3 southern African species experience less extreme climatic conditions, and live to a greater extent in savanna (as well as desert) compared to the 4 Saharan/Arabian/Indian species, *coronatus, senegallus, lichtensteini* and *indicus* (Thomas & Maclean 1981, Thomas *et al.* 1981), and so selection for "unpatterned" downy young may not have been so strong in the southern African species.

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References:

Aldrich, H. C. 1943. Some notes on the Common Sandgrouse (*Pterocles exustus* Temminck) in Kaira District. *J. Bombay Nat. Hist. Soc.* 44: 123–125.

Ali, S. & Ripley, S. D. 1969. *Handbook of the Birds of India and Pakistan.* Vol. 3. Oxford University Press: Bombay.

Bowen, W. W. 1927. Remarks on the classification of the Pteroclididae. *Am. Mus. Novit.* 273: 1–12.

Fjeldsaa, J. 1976. The systematic affinities of sandgrouse, Pteroclididae. *Vidensk. Meddelr Dansk Naturhist. Foren.* 139: 179–243.

Fjeldsaa, J. 1977. *Guide to the Young of European Precocial Birds.* Skarv Nature Publications: Tisvildeleje, Denmark.

George, U. 1978. *In the Deserts of this Earth.* Hamilton: London.

Harrison, C. J. O. 1975. *A Field Guide to the Nests, Eggs, and Nestlings of British and European Birds.* Collins: London.

Hüe, F. & Etchécopar, R. D. 1957. Les Ptéroclididés. *L'Oiseau et R.F.O.* 27: 35–58.

Mackworth-Praed, C. W. & Grant, C. H. B. 1952. *Birds of Eastern and North Eastern Africa.* Vol. 1. Longman: London.

Maclean, G. L. 1968. Field studies on the sandgrouse of the Kalahari Desert. *Living Bird.* 7: 209–235.

Maclean, G. L. 1976. Adaptations of sandgrouse for life in arid lands. *Proc. Int. Orn. Congr.* 16: 502–516.

Meinertzhagen, R. 1954. *Birds of Arabia.* Oliver & Boyd: Edinburgh.

Munsell Color. 1975. *Munsell Soil Color Charts.* Munsell Color: Baltimore.

Thomas, D. H. & Maclean, G. L. 1981. Comparison of physiological and behavioural thermoregulation and osmoregulation in two sympatric sandgrouse species (Aves: Pteroclididae). *J. Arid Environments* 4: 335–358.

Thomas, D. H., Maclean, G. L. & Clinning, C. F. 1981. Daily patterns of behaviour compared between two sandgrouse species (Aves: Pteroclididae) in captivity. *Madoqua* 12: 187–198.

Thomas, D. H. & Robin, A. P. 1977. Comparative studies of thermoregulatory and osmoregulatory behaviour and physiology of five species of sandgrouse (Aves: Pteroclididae) in Morocco. *J. Zool. Lond.* 183: 229–249.

Address: Dr. D. H. Thomas, Department of Zoology, University College (University of Wales), Cardiff CF1 1XL, U.K.
Dr. A. P. Robin, Centre Hospitalier, Morlaix-Cedex, 29205 France.